




## First record of gynandromorphism in the subfamily Dryininae (Hymenoptera, Dryinidae)


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**ABSTRACT.** A gynander specimen belonging to the genus *Dryinus* Latreille, 1804 (Hymenoptera: Dryinidae) is described from Ecuador (Zamora Province). It has a female aspect, but with male genitalia, no chelae and no Antennal Dorsal Organs (ADOs). This is the first record of a gynander specimen of Dryininae.

**Key words:** Chrysidioidea, *Anteon*, *Deinodryinus*, *Dryinus*, *Gonatopus*, taxonomy

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### INTRODUCTION

The family Dryinidae (Hymenoptera: Aculeata, Chrysidioidea) includes parasitoids and often also predators of Auchenorrhyncha (Hemiptera) (Olmi, 1984; Guglielmino et al., 2013). They are commonly named “pincer wasps” because most females are provided with chelae used for capturing and restraining their hosts (Olmi, 1984). Many species are predators, i. e. they practice the host-feeding (consumption of host haemolymph and tissues by the adult female) (Olmi, 1994a).

Gynander or Gynandromorph is an organism showing both female and male characteristics (for further information see the following discussion) (Olmi & Virla, 2014). In the family Dryinidae, gynanders are very rare. The first gynander specimen described in the family is *Anteon scapulare* (Haliday in Walker, 1837) (Anteoninae), described from England (Palaeartic region) by Richards (1948). Many years after, other gynandromorph specimens were discovered in the Neotropical region: *Gonatopus cavazzutii* Olmi, 1987 (Gonatopodinae) from Ecuador; *Gonatopus desantisi* Olmi & Virla, 1993 (Gonatopodinae) from Argentina (Virla, 2001). The first gynander specimens of Dryinidae from the Afrotropical region were described by Olmi et al. (2019) from Madagascar: *Deinodryinus rusticus* Olmi, 2004 and *D. steineri* Olmi, 1994b (Anteoninae). Gynanders of Dryinidae are unknown in other zoogeographic regions (Australasian, Nearctic, Oriental regions). The above records regard the subfamilies Anteoninae and Gonatopodinae. In 2021, the authors received for identification a small

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collection of Dryinidae deposited in the Zoological Museum of the Pontificia Universidad Católica del Ecuador (PUCE), Quito, Ecuador. Among the examined material, a gynander belonging to Dryininae, was recognized (first record for the subfamily). It is described in the present paper.

## MATERIAL AND METHODS

The description follows the terminology used by Olmi et al. (2019). The measurements reported are relative, except for the total length (head to metasomal tip, excluding antennae and sting), which is expressed in millimeters. The following abbreviations are used in the descriptions: POL – the distance between the inner edges of the two lateral ocelli, OL – the distance between the inner edges of a lateral ocellus and the median ocellus, OOL – the distance from the outer edge of a lateral ocellus to the compound eye, OPL – the distance from the posterior edge of a lateral ocellus to the occipital carina, TL – the distance from the posterior edge of an eye to the occipital carina. The term “disc of metapectal-propodeal complex” is here used in the sense of Kawada et al. (2015). It corresponds to the term “dorsal surface of propodeum” *sensu* Olmi (1984). The term “propodeal declivity” *sensu* Kawada et al. (2015) used here, corresponds to the term “posterior surface of propodeum” *sensu* Olmi (1984). The names of veins of the forewing are here used in the sense of Olmi et al. (2019). The “stigmal vein” (*sensu* Olmi 1984) is here named “second radial-radial sector crossvein & radial sector vein (2r-rs&Rs)”. The term “ADOs” (= Antennal Dorsal Organs) is here used in the sense of Riolo et al. (2016). It corresponds to the term “rhinaria” *sensu* Olmi (1984). The multifocal photos were taken using a mirrorless Sony Alpha 6100 camera (Sony Group Corporation, Tokyo, Japan), with Canon bellows and three-way revolver for optical microscopy (Canon Inc., Tokyo, Japan). The following objectives were used: LOMO 3.7 × 0.11 (LOMO, St. Petersburg, Russia) for magnifications from 20 to 50x; Zeiss Semiplan 6.3 × 0.11 (Carl Zeiss GmbH, Jena, Germany) for magnifications from 50 to 100x. Motorized focus managed by a Cognisys stackshot controller (Cognisys Inc., Traverse City, MI, USA). Captured images were merged into a single in-focus image using ZereneStacker™ version 1.04 (Zerene Systems LLC, Richland, WA, USA).

The types of all Neotropical species of *Dryinus* have been previously examined by the authors. The specimen studied in this paper is deposited in the collections of the Zoological Museum, Pontificia Universidad Católica del Ecuador (PUCE), Quito, Ecuador (QCAZ).

## RESULTS

### Taxonomic Hierarchy

Order **Hymenoptera** Linnaeus, 1758

Suborder **Apocrita** Gerstaecker, 1867

Superfamily **Chrysidoidea** Latreille, 1802

Family **Dryinidae** Haliday, 1833

Subfamily **Dryininae** Haliday, 1833

Genus *Dryinus* Latreille, 1804

### Gynander of *Dryinus* sp.

**Material examined.** ECUADOR: Zamora Chinchipe, Canton Yanzatza, Los Encuentros, 3°45'28.8"S 78°31'09.8"W, 1322 m, 15.XII.2010, ex Trampa (= Trap) Malaise, T. Ghia leg., 1 gynander specimen (QCAZ).

**Description. Male with female aspect:** fully winged (Figs 1A, B); length 4.2 mm.

Head black, except mandible, clypeus and narrow frontal stripe near clypeus testaceous; antenna brown, except scape and pedicel testaceous; mesosoma black; metasoma brown; fore leg testaceous; mid and hind leg brown, except trochanter and part of tarsus testaceous. Antenna clavate, with female aspect, without ADOs. Antennomeres in following proportions: 8:5:26:14:13:13:11:10:9:11. Head slightly convex, dull, granulate; frontal line incomplete, only present in posterior half of frons; occipital carina

complete; vertex with two oblique keels joining posterior ocelli to occipital carina (Fig. 1C); POL=4; OL=5; OOL=4; OPL=3; TL=5. Palpal formula 6/3. Pronotum with disc humped, shiny, unsculptured; posterior collar short; furrow between disc and posterior collar sculptured by longitudinal keels; pronotal tubercles not reaching tegulae. Mesoscutum dull, granulate. Notauli incomplete, reaching about 0.8× length of mesoscutum (Fig. 1D). Mesoscutellum dull, granulate. Metanotum small dull. Epicnemium exposed (Fig. 1E). Metapectal-propodeal complex dull, reticulate rugose, with two longitudinal keels on propodeal declivity. Disc of metapectal propodeal declivity much longer than propodeal declivity (25:13). Fore wing hyaline, with two dark transverse bands (Fig. 1A), with distal part of 2r-rs&Rs vein much longer than proximal part (28:5), not reaching fore wing margin. Hind wing hyaline. Shape of fore leg similar to that of normal females of *Dryinus*. Protarsus without chela (Fig. 1B). Male genitalia with paramere about as long as aedeagus (Fig. 2); volsella slightly shorter than paramere and aedeagus (Fig. 2). Tibial spurs 1/1/2.

**Distribution.** Ecuador (Neotropical region).

**Host.** Unknown.

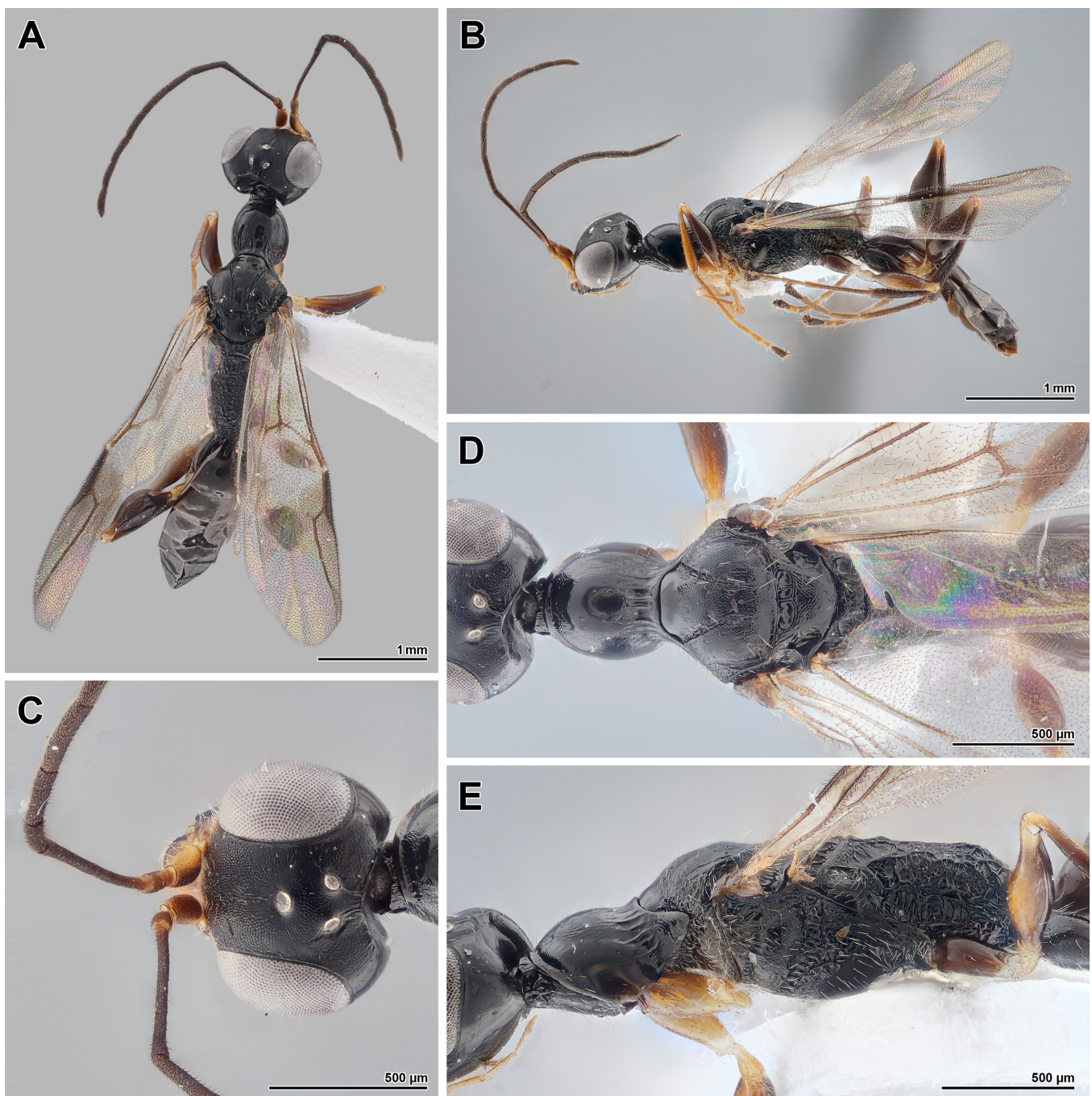
## DISCUSSION

The specimen above described is the first gynander specimen of *Dryinus* (Dryininae). Previously gynander specimens of Dryinidae were known only in the subfamilies Anteoninae (Richards, 1948; Olmi et al., 2019) and Gonatopodinae (Olmi, 1987; Virla, 2001; Olmi & Virla, 2014). This specimen has male genitalia (Fig. 2). However, it has a female look in all parts of its body (Figs 1A, B), but no chelae (Fig. 1B), no ovipositor and no antennal ADOs (almost all females of *Dryinus* have antennal ADOs). ADOs are sensory structures, that might mediate the antennal responses to vibratory stimuli. As far as we know, they are present in the antennae of dryinid females attacking Fulgoromorpha (Perkovsky et al., 2019). Because of its anomalous aspect, it is impossible to attribute this specimen to a known species. The authors tried to compare this gynander to the other females of Neotropical species. However, this effort did not have any success. Apparently, this gynander is a new species or its aspect is so modified that it is not similar to any known species. Anyway, it is attributed to the genus *Dryinus* because of the general look (prothorax mobile, elongated and disarticulated, with a transverse impression), palpal formula 6/3, ocelli present, epicnemium exposed, fore wing with three basal cells enclosed by pigmented veins, tibial spurs 1/1/2.

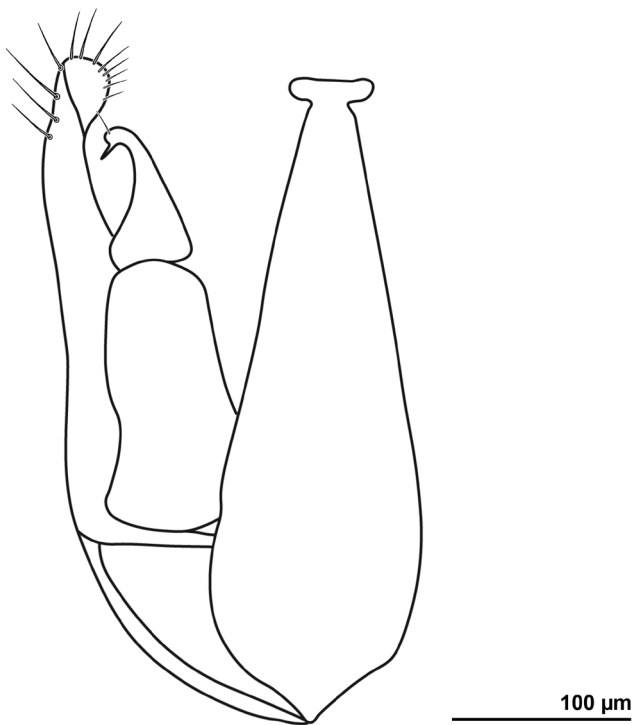
Gynandromorphs are individuals with a mix of male and female traits (Triplehorn & Johnson, 2005; Alvarez et al., 2019; Sommaggio et al., 2021). This phenomenon is mainly caused by anomalous mitosis at the beginning of the embryo development. One of the dividing cells does not split its sex chromosomes normally, so that it develops a male, while the other cell has sex chromosomes that cause female development. Bilateral gynandromorphy (i. e., one side female and one side male) happens very early in development when the embryo has between 8 and 64 cells. Mosaic gynandromorphy (i. e. random distribution of male and female tissues) happens in later stages of the embryo development.

Gynandromorphs are characterized in three main types according to Michez et al. (2009): mosaic (when female and male characters are distributed randomly), transverse (when sex characters are distributed in two asymmetrical parts) and bilateral (when one side of the body has male characters and the other female). All cases of gynandromorphism observed in dryinids, including that described in this paper, show a mosaic distribution of the characters of the opposite sexes. Gynandromorphism is very rare in Chrysidoidea. No gynandromorphs are reported in the families Bethyridae (Azevedo pers. comm.), Plumariidae, Sclerogibbidae and Scolebythidae. In Chrysididae, few cases are reported from Austria, France, Germany and Greece (Paolo Rosa pers. comm.) (Rosa & Zettel, 2018; Rosa, 2019; Strumia, 2004; Wolf, 2004). In Embolemidae, many gyncanders of *Embolemus zealandicus* Olmi, 1996 were reported from New Zealand by Olmi (1996).

A comparison with the other known gynandromorph specimens known in the family Dryinidae shows that the specimen of *Dryinus* described herein is the only gynander with a female aspect. The only known gynandromorph of *Gonatopus cavazzutii* from Ecuador has a winged male look, with ovipositor and only the right chela (Olmí & Virla, 2014). The two known gynanders of *Gonatopus desantisi* from Argentina have a mixed aspect, part female and part male, with ovipositor, part of the wings and with no chelae (Olmí & Virla, 2014). The only known gynanders of *Deinodryinus rusticus* and *D. steineri* from Madagascar have an aspect of fully winged male, with ovipositor, no male genitalia and no chelae (Olmí et al., 2019).



**Figure 1.** Gynandromorph specimen of *Dryinus* from Ecuador. **A.** Body, dorsal view; **B.** Body, lateral view; **C.** Head, dorsal view; **D.** Mesosoma, dorsal view; **E.** Mesosoma, lateral view.



**Figure 2.** Male genitalia of gynandromorph specimen of *Dryinus* from Ecuador. right half removed.

In the family Embolemidae, the only species with known gynanders is *Embolemus zealandicus* from New Zealand. Almost all gynanders of this species have a fully winged male aspect, with male genitalia, but with female antennae (Olmi et al., 2016). One gynander has a micropterous female look, with male genitalia and male ocelli (Olmi, 1996). In the family Chrysididae, Strumia (2004) described a gynander of *Cleptes triestensis* Móczár, 2000, from Corsica (France) with mixed mosaic colours of male and female, in addition to ovipositor and almost complete male genitalia. Rosa & Zettel (2018) described a gynander of *Holopyga fervida* (Fabricius, 1781) from Austria with mixed mosaic colours of male and female, but prevalent female aspect. In turn, Rosa (2019) described a gynander of *Cleptes semiauratus* (Linnaeus, 1761) from Germany, with predominant male aspect, but with some regions characterized by a female colour. Finally, Wolf (2004) described a bilateral gynander of *Chrysis pseudodichroa* Linsenmaier, 1959, from Greece.

#### AUTHOR'S CONTRIBUTION

The authors confirm their contribution to the paper as follows: MO wrote the manuscript; AG worked with the figures; GO worked with the material; all authors were involved in the identification, discussed the results and contributed to the final manuscript.

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#### AVAILABILITY OF DATA AND MATERIAL

Diego Guevara, curator of the Zoological Museum, Pontificia Universidad Católica del Ecuador (PUCE), Quito, Ecuador (QCAZ), lent the specimen studied in this paper.

#### ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

## CONSENT FOR PUBLICATION

Not applicable.

## CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this paper.

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## اولین گزارش از ژیناندرومورفیسیم در زیر خانواده Dryininae (Hymenoptera, Dryinidae)

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**چکیده:** یک نمونه دوجنسیتی متعلق به جنس *Dryinus* Latreille, 1804 (Hymenoptera: Dryinidae) از اکوادور، استان زامورا توصیف شد. این نمونه خصوصیات حشره ماده را دارد، اما با جنیتالیای نر، بدون انبرک و بدون اندام پستی شاخکی (ADOs). این اولین مورد از ثبت یک نمونه دوجنسیتی از زیر خانواده Dryinidae می‌باشد.

**واژگان کلیدی:** کریزیده‌ها، آنتئون، دینودرینوس، درینوس، گوناتوپوس، تاکسونومی